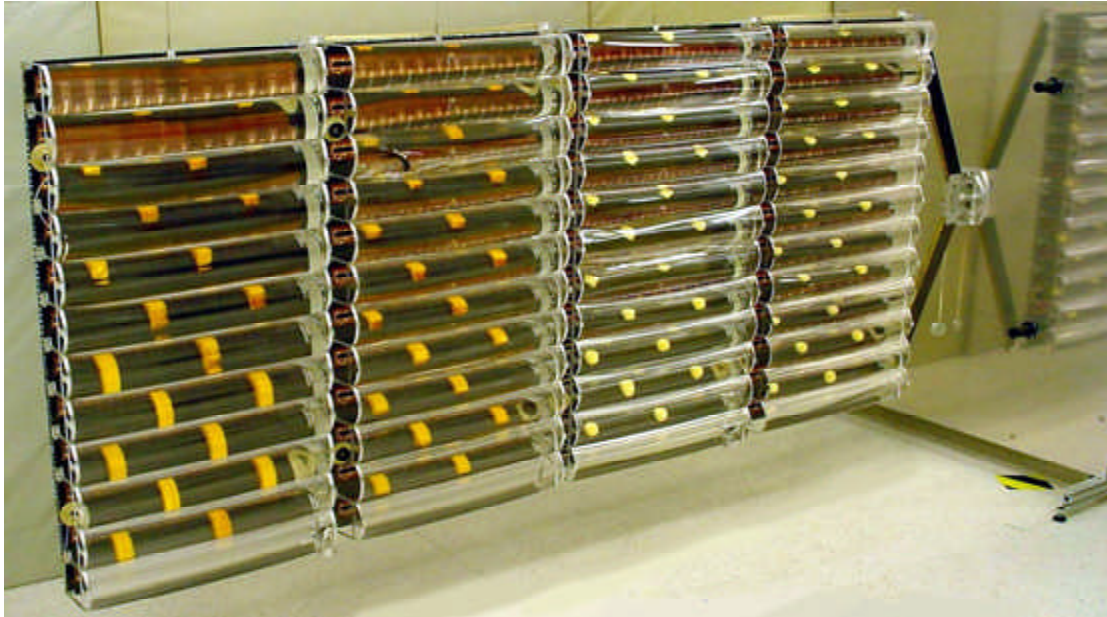


# Stretched Lens Array Photovoltaic Concentrator Technology Developed

Solar arrays have been and continue to be the mainstay in providing power to nearly all commercial and government spacecraft. Light from the Sun is directly converted into electrical energy using solar cells. One way to reduce the cost of future space power systems is by minimizing the size and number of expensive solar cells by focusing the sunlight onto smaller cells using concentrator optics. The stretched lens array (SLA) is a unique concept that uses arched Fresnel lens concentrators to focus sunlight onto a line of high-efficiency solar cells located directly beneath. The SLA concept is based on the Solar Concentrator Array with Refractive Linear Element Technology (SCARLET) design that was used on NASA's New Millennium Deep Space 1 mission. The highly successful asteroid/comet rendezvous mission (1998 to 2001) demonstrated the performance and long-term durability of the SCARLET/SLA solar array design and set the foundation for further improvements to optimize its performance.

Although SLA uses the same basic concept as SCARLET (an arched-linear refractive concentrator to focus light onto solar cells below), a number of refinements have been made that dramatically decrease the weight and stowed volume of the design. The linear concentrator lenses, made from a flexible, space-qualified clear silicone can now be stowed flat against the solar cells, greatly reducing weight and complexity. As the individual panels of the solar array are deployed for in-space operation, the concentrator lenses are "stretched" at the proper position above the cells, providing excellent operational performance with minimal excess hardware or mechanical complexity. A deployed four-panel prototype wing is shown in the photograph. The reduction in concentrator weight and deployment mechanisms has also enabled further weight reductions to the inboard honeycomb panels. These improvements, combined with additional features such as high-voltage operational capability and minimal degradation in high-radiation environments, have led to the demonstration of 3- to 4-fold specific power improvements over the previous SCARLET design and other state-of-the-art solar arrays. These technology advancements were accomplished under a NASA Glenn Research Center contract with Entech, Inc., with support from AEC-Able Engineering.



*Four-panel prototype wing of the stretched lens array (SLA) in deployed mode. On the second panel from the left, lines of concentrator solar cells can be seen beneath the linear concentrator lenses.*

The near-term design demonstrated in the photograph supports a wide variety of NASA missions. The radiation-tolerant and high-voltage capabilities are particularly applicable to deep-space science missions and those using solar electric propulsion technology. The cost-reduction benefits of photovoltaic concentrator arrays also make the SLA technology appealing for a number of commercial and other Government space systems. Concepts for very high power ( $>100$  kW) SLA systems are currently being studied. These designs have the potential to enable various future NASA missions and would help further the commercial development of space.

**Find out more about this research:** <http://www.entechsolar.com>

**Glenn contact:** Michael F. Piszczor, Jr.; 216-433-2237, [Michael.F.Piszczor@nasa.gov](mailto:Michael.F.Piszczor@nasa.gov)

**Authors:** Michael F. Piszczor, Jr., and Mark J. O'Neill

**Headquarters program office:** OAT

**Programs/Projects:** Energetics, SSP